Journal of Social Science and Humanities
June 2026, Vol. 1 No. 3, pp. 384-393
ISSN(*e*): 3124-0321 | ISSN(*p*): 3124-0313
DOI: https://doi.org/10.54012/jssh.v1i3.769

Residential Fire in Malaysia, April 2026: An Analysis of Its Impacts on Coastal Ecosystems, Air Quality, and Public Health

Nadiyah Zaskia Farida [1]✉, Nia Dwinta [2], Ririn Oktavia [3], Siti Nursyahrani[4]
[1] *Environmental Engineering Study Program, Universitas Pelita Bangsa, Bekasi, Indonesia*
[1*]Email: zaskianadiyah@gmail.com

[2] *Environmental Engineering Study Program, Universitas Pelita Bangsa, Bekasi, Indonesia*
[2]Email: niadwinta@gmail.com

[3] *Environmental Engineering Study Program, Universitas Pelita Bangsa, Bekasi, Indonesia*
[3]Email: ririnkariim@gmail.com

[4] *Environmental Engineering Study Program, Universitas Pelita Bangsa, Bekasi, Indonesia*
[4]Email: sitinursyahrani73@gmail.com

Article History

Received:
April 28, 2026

Revised:
May 23, 2026

Accepted:
May 28, 2026

Published:
June 30, 2026

ABSTRACT

Residential fires constitute one of the major disasters that generate multidimensional impacts on social, economic, public health, and environmental systems. In April 2026, a large-scale residential fire occurred in Kampung Bahagia, Sabah, Malaysia, destroying approximately 1,000 houses and leaving thousands of residents displaced. This study aims to analyze the impacts of the fire on coastal ecosystems, air quality, and public health from an environmental ecology perspective. The research employed a qualitative descriptive approach through a literature review, utilizing secondary data obtained from scientific articles, peer-reviewed journals, fire incident reports, and other relevant supporting documents. The findings indicate that the fire contributed to the contamination of the coastal environment through the deposition of combustion residues, including ash, charcoal, heavy metals, and synthetic materials, into adjacent water bodies, thereby posing potential threats to ecological balance. Furthermore, the fire emitted significant air pollutants, including particulate matter ($PM_{2.5}$ and PM_{10}), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), and polycyclic aromatic hydrocarbons (PAHs), resulting in deteriorated air quality and an increased risk of adverse health outcomes, particularly acute respiratory infections (ARI), asthma, bronchitis, and eye irritation. The study further reveals that the vulnerability of coastal settlements to residential fires is strongly influenced by high housing density, the widespread use of combustible building materials, and the limited availability of fire mitigation systems and emergency response infrastructure. Therefore, strengthening disaster risk reduction strategies, enhancing community preparedness and resilience, improving spatial planning in coastal areas, and implementing continuous environmental quality monitoring are essential to reducing the likelihood and impacts of similar incidents in the future.

Keywords: *residential fire; coastal ecosystem; air quality; public health; disaster risk reduction.*

Contribution/Originality: This study contributes to the existing literature by providing an integrated environmental ecology assessment of the April 2026 residential fire in Kampung Bahagia, Sabah, Malaysia. Unlike previous studies that have generally focused on the social or economic consequences of residential fires, this research simultaneously examines the interrelated impacts on coastal ecosystems, air quality, and public health.

1. INTRODUCTION

Fire is one of the major disasters that exerts significant impacts on human life and the environment. In addition to causing substantial economic and social losses, fires can lead to ecosystem degradation and adverse public health outcomes through the environmental pollution they generate. Previous studies have demonstrated that the impacts of fire are not limited to the duration of the event itself but may persist over the long term due to changes in environmental conditions and the quality of life of affected communities (Anhar et al., 2022).

The relationship between humans and the environment is inherently reciprocal. Human activities influence environmental conditions, while environmental changes, in turn, affect human well-being. According to Kristanto (2004), the interaction between humans and the environment is cyclical, whereby environmental degradation resulting from human activities can trigger a range of ecological and social problems. This reciprocal relationship is particularly evident in large-scale residential fires occurring in densely populated settlements.

In April 2026, a major residential fire occurred in Kampung Bahagia, Sabah, Malaysia, destroying approximately 1,000 houses. The incident represents one of the largest residential fire disasters to affect Malaysia's coastal regions in recent years. The high population density, the predominance of semi-permanent wooden structures, and limited access for firefighting operations facilitated the rapid spread of the fire and hindered effective suppression efforts.

Beyond the extensive physical destruction, the fire generated considerable environmental consequences. Ash and combustion residues have the potential to contaminate surrounding coastal water bodies, while the combustion process released a variety of atmospheric pollutants that may adversely affect public health. According to Arum et al. (2021), fires constitute a significant source of air pollution, contributing to elevated concentrations of particulate matter and hazardous gases in the atmosphere.

Based on these considerations, this study aims to analyze the impacts of the April 2026 residential fire on coastal ecosystems, air quality, and public health through the lens of environmental ecology. The findings are expected to contribute to a better understanding of the environmental consequences of residential fires in coastal areas and to provide scientific evidence for strengthening disaster risk reduction, environmental management, and public health protection strategies in vulnerable coastal communities.

1. Environmental Ecology Theory

Environmental ecology is the scientific discipline that examines the interactions between living organisms and their surrounding environment. From an ecological perspective, humans are regarded as integral components of environmental systems that continuously interact with both biotic and abiotic elements. Consequently, disturbances or degradation affecting any component of the environment can disrupt the balance and functioning of the entire ecological system. As noted by Kristanto (2004), environmental systems are characterized by interconnected and reciprocal relationships, whereby changes in one component inevitably influence the stability and sustainability of the ecosystem as a whole.

2. Fire and Environmental Impacts

Fires may be triggered by either natural factors or human activities. However, anthropogenic factors are recognized as the predominant cause of fire incidents in both forested areas and residential settlements. Cahyono et al. (2015) reported that human activities, land-use practices, and the presence of fire hotspots are the primary factors influencing the occurrence and spread of fires.

Based on an analysis of conditions in Kampung Bahagia, Malaysia, the close proximity of residential buildings, the predominance of dry wooden construction materials, and strong wind conditions were identified as the main factors contributing to the rapid spread of the April 2026 fire. These conditions substantially increased the fire hazard and complicated firefighting operations due to the limited accessibility of the densely populated settlement (Mara et al., 2023).

Fire events cause significant environmental changes, including air pollution, water contamination, soil degradation, and the loss of biodiversity. These environmental impacts may persist over the long term if appropriate environmental rehabilitation and ecosystem restoration measures are not implemented. Such degradation can impair ecosystem functions, reduce environmental quality, and diminish the capacity of affected areas to support both ecological processes and human well-being.

3. Health Impacts of Fire

Smoke generated by fires contains a wide range of hazardous pollutants, including fine particulate matter ($PM_{2.5}$), coarse particulate matter (PM_{10}), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen oxides (NO_x), and polycyclic aromatic hydrocarbons (PAHs). Exposure to these pollutants has been associated with numerous adverse health outcomes, including acute respiratory infections (ARIs), asthma, bronchitis, eye irritation, and cardiovascular diseases (Anhar et al., 2022). Fine particulate matter, particularly $PM_{2.5}$, poses a significant health risk because of its ability to penetrate deep into the respiratory tract and enter the bloodstream, thereby increasing both respiratory and cardiovascular morbidity

2. METHOD

This study employed a qualitative descriptive research design using a literature review approach. The study relied exclusively on secondary data collected from various sources, including the paper *"Residential Fire in Malaysia, April 2026"*, peer-reviewed national scientific journals, scholarly articles addressing fire incidents and environmental pollution, as well as relevant policy documents and official reports.
Data were analyzed using qualitative content analysis. The analytical process consisted of four stages: data reduction, data presentation, data interpretation, and conclusion drawing. This approach enabled the systematic identification, synthesis, and interpretation of information concerning the environmental and public health impacts of the April 2026 residential fire, with particular emphasis on its effects on coastal ecosystems, air quality, and community health.

3. FINDINGS AND DISCUSSION

a. Impacts on Coastal Ecosystems

Residential fires introduce a wide range of combustion residues into coastal environments. Ash, charcoal, plastics, metals, and other construction debris can be transported by surface runoff during rainfall into adjacent rivers, estuaries, and coastal waters. The accumulation of these materials has the potential to degrade water quality by increasing turbidity and altering key physicochemical parameters, including pH, dissolved oxygen (DO), and total suspended solids (TSS). Such changes may disrupt aquatic ecosystem functioning, reduce habitat quality, and adversely affect the survival and diversity of aquatic organisms.

Table 1. Fire Impacts on Coastal Ecosystems

Component	Impact
Water Quality	Increased turbidity and contamination
Aquatic Biota	Habitat disruption and impaired reproduction
Mangrove Ecosystems	Reduced ecological functions
Fisheries	Decline in productivity

Air Pollutant	Impact
PM2.5	Pulmonary impairment and reduced lung fun
PM10	Respiratory tract irritation
CO	Reduced oxygen-carrying capacity of the blood
NOx	Respiratory system disorders
PAHs	Carcinogenic effects

Health Condition	Impact
Acute Respiratory Infection (ARI)	Coughing and shortness of breath
Asthma	Exacerbation of asthma symptoms
Eye Irritation	Eye redness and burning sensation
Cardiovascular Disease	Impairment of cardiac and vascular function

Figure 1. Forest Fire

These findings are consistent with those reported by Anhar et al. (2022), who demonstrated that fire events have significant impacts on environmental quality and community well-being. The large-scale residential fire that occurred in Kampung Bahagia, Sandakan, Sabah, Malaysia, in April 2026 had substantial consequences for the surrounding coastal environment. The destruction of approximately 1,000 stilt houses generated large quantities of combustion residues, including ash, charred wood, metals, plastics, and domestic waste, all of which have the potential to contaminate adjacent coastal waters. The accumulation of these residues can degrade water quality and alter the physical and chemical characteristics of aquatic environments that serve as critical habitats for coastal organisms. Furthermore, the transport of combustion-derived materials into water bodies may increase suspended solids and disrupt the ecological balance of coastal ecosystems (Chokkalingam et al., 2005).

The deterioration of environmental quality following the fire may also threaten the survival and functioning of coastal biota. Elevated sediment loads and pollutant concentrations can reduce light penetration into the water column, thereby limiting photosynthetic activity in primary producers such as seagrasses and phytoplankton. This reduction in primary productivity may subsequently affect trophic interactions and the stability of coastal food webs. Over the long term, persistent environmental degradation may alter the abundance and distribution of fish, mollusks, and benthic organisms, which constitute essential ecological resources and important sources of livelihood for coastal communities (Rizwan et al., 2024).

In addition to its ecological consequences, the Kampung Bahagia fire resulted in substantial social and economic impacts. Thousands of residents were displaced after losing their homes, while economic activities dependent on coastal resources—including fisheries, local trade, and small-scale enterprises—were severely disrupted.

Consequently, post-fire recovery efforts should extend beyond the physical reconstruction of residential areas to include comprehensive environmental rehabilitation and the restoration of coastal ecosystem functions. Such an integrated approach is essential for promoting ecological resilience, safeguarding ecosystem services, and supporting the long-term recovery and well-being of affected coastal communities (Carroll et al., 2011).

b. Impacts on Air Quality

Fire events release a wide range of atmospheric pollutants that pose significant risks to human health. Fine particulate matter ($PM_{2.5}$) and coarse particulate matter (PM_{10}) are among the primary pollutants responsible for the deterioration of air quality. According to Arum et al. (2021), elevated concentrations of fire-related pollutants can adversely affect public health in both the short and long term.

The large-scale fire that occurred in Kampung Bahagia, Sandakan, Sabah, in April 2026 likely had substantial impacts on local air quality due to the emission of smoke and fine particles generated by the combustion of residential building materials. The burning of wood, plastics, synthetic materials, and household waste released considerable quantities of particulate matter, particularly PM_{10} and $PM_{2.5}$, which can remain suspended in the atmosphere for extended periods. Elevated concentrations of these fine particles constitute a major indicator of declining air quality, as they reduce visibility and increase the risk of respiratory disorders among exposed populations (Sopčić et al., 2025).

Previous studies have consistently shown that fire events can significantly increase ambient $PM_{2.5}$ concentrations compared with normal background levels. Owing to their extremely small aerodynamic diameter, $PM_{2.5}$ particles can penetrate deeply into the pulmonary alveoli, thereby posing serious health risks, especially for children, older adults, and individuals with pre-existing respiratory conditions. In addition to particulate matter, fire smoke contains organic carbon (OC), elemental carbon (EC), and black carbon (BC), all of which contribute to air quality degradation and may exert long-term adverse effects on both human health and the environment. Consequently, post-fire air quality monitoring represents a critical component of disaster mitigation and environmental recovery strategies (Aguilera et al., 2021).

In coastal environments such as Kampung Bahagia, the dispersion of airborne pollutants is strongly influenced by meteorological conditions, particularly wind speed and wind direction. Smoke plumes and particulate matter generated during combustion can be transported over considerable distances, extending the impacts of the fire well beyond the immediate burn area. Several studies have demonstrated that although particulate concentrations generally decline after the fire has been extinguished, residual ash and fine dust may continue to impair air quality for a prolonged period. Therefore, post-fire recovery efforts should incorporate regular air quality monitoring to ensure that

environmental conditions have returned to levels that are safe for surrounding communities (da Silva et al., 2020; Li et al., 2021).

c. Impacts on Public Health

The large-scale residential fire that occurred in Kampung Bahagia, Sandakan, Sabah, in April 2026 had significant consequences for public health, primarily due to exposure to smoke and combustion-derived particulate matter. Fire smoke contains a variety of hazardous pollutants, including fine particulate matter ($PM_{2.5}$), carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOCs), all of which can adversely affect the respiratory system. Exposure to these pollutants may cause eye irritation, coughing, shortness of breath, and the exacerbation of pre-existing respiratory diseases, such as asthma and chronic obstructive pulmonary disease (COPD). Vulnerable populations—including children, older adults, and pregnant women—are particularly susceptible to the adverse health effects associated with post-fire air pollution (Aguilera et al., 2021).

Beyond its physical health consequences, the fire also imposed substantial psychological burdens on affected communities. The loss of homes, personal belongings, and livelihoods, together with uncertainty during the post-disaster recovery period, may increase the prevalence of stress, anxiety, and other mental health disorders. Previous studies have demonstrated that survivors of residential fire disasters frequently experience emotional distress that may persist in both the short and long term. Consequently, disaster recovery programs should incorporate not only medical services but also comprehensive mental health and psychosocial support to facilitate community resilience and long-term recovery (Mundakir, 2017; Rahayu, 2022).

The crowded conditions in temporary evacuation shelters further increase the risk of public health problems, including acute respiratory infections (ARIs), skin diseases, and sanitation-related illnesses. Limited access to clean water, inadequate sanitation facilities, and high population density within evacuation centers create conditions conducive to the transmission of communicable diseases. Therefore, an integrated response involving government agencies, healthcare providers, and humanitarian organizations is essential to ensure that the health needs of affected populations are adequately addressed throughout both the emergency response and post-fire recovery phases (Ambodale et al., 2024).

Exposure to fire smoke substantially increases the risk of respiratory illnesses, with vulnerable groups—including children, older adults, pregnant women, and individuals with chronic diseases—experiencing the greatest health burden. Furthermore, when these populations are relocated to Temporary Evacuation Centers (TECs), they face disproportionately greater health risks. Their physiological vulnerability is often compounded by inadequate ventilation and overcrowded living conditions within emergency shelters, thereby increasing the likelihood of respiratory complications and infectious disease transmission (WHO Global Air Quality Guidelines, n.d.).

Evidence from previous studies indicates that respiratory diseases constitute the predominant health outcome associated with fire smoke exposure, accounting for more than 80% of reported smoke-related health cases (Anhar et al., 2022). In addition to respiratory morbidity, prolonged exposure to smoke and the traumatic experience of the disaster may increase the risk of long-term physical and psychological health problems. Consequently, residential fire disasters not only compromise physical health but also contribute to sustained stress, trauma, and reduced quality of life among affected communities, underscoring the importance of integrated public health interventions during disaster recovery (Romsan & Antoni, 2024).

d. Environmental Ecology Analysis

From an environmental ecology perspective, residential fires are the result of complex interactions between anthropogenic activities and environmental conditions. High building density, the widespread use of combustible construction materials, and inadequate fire mitigation systems collectively increase the vulnerability of residential areas to fire disasters. These factors not only facilitate fire ignition and rapid spread but also exacerbate the severity of environmental and socioeconomic impacts.

Environmental degradation resulting from residential fires extends beyond the immediate destruction of infrastructure and affects both ecosystem integrity and human well-being. Consequently, integrated disaster risk reduction and mitigation strategies are essential to minimize the likelihood and consequences of future fire events. Such strategies should combine effective land-use planning, improved building standards, enhanced emergency response capacity, and community-based preparedness to strengthen the resilience of vulnerable settlements.

Residential fires may also adversely affect soil biodiversity by reducing the abundance and diversity of organisms that play critical roles in maintaining soil fertility and ecosystem functioning. In addition, combustion processes can alter soil chemical properties, including short-term increases in soil pH and the availability of certain nutrients. However, these temporary changes may be accompanied by long-term reductions in cation exchange capacity, deterioration of soil quality, and diminished ecological stability.

In the context of residential fires, combustion residues—including ash, soot, heavy metals, and burned construction materials—may be transported by surface runoff into drainage systems and adjacent coastal water bodies. The accumulation of these contaminants has the potential to degrade environmental quality, disrupt terrestrial and aquatic organisms, and reduce the capacity of ecosystems to maintain their ecological functions. Therefore, comprehensive post-fire assessments of soil quality, water quality, and vegetation condition should be incorporated into long-term environmental recovery programs to support sustainable ecosystem restoration and enhance the resilience of fire-affected landscapes (Penelitian et al., 2012)

4. CONCLUSION

The residential fire that occurred in Kampung Bahagia, Sabah, Malaysia, in April 2026 had significant environmental and public health consequences. The identified impacts included the contamination of coastal ecosystems, deterioration of air quality resulting from the emission of hazardous pollutants, and an increased risk of adverse health outcomes among affected communities. These findings underscore the interconnected nature of environmental degradation and human well-being within the framework of environmental ecology.

To reduce the likelihood and severity of similar incidents in the future, it is essential to strengthen community capacity, enhance fire prevention and mitigation systems, improve spatial planning and land-use management in coastal areas, and implement continuous environmental quality monitoring. Adopting these integrated measures will not only improve disaster preparedness and resilience but also support the long-term sustainability of coastal ecosystems and the health and well-being of communities living in fire-prone areas.

5. ACKNOWLEDGMENTS

The authors gratefully acknowledge the Environmental Engineering Study Program, Universitas Pelita Bangsa, Bekasi, Indonesia, for providing academic support and an encouraging research environment throughout the completion of this study. The authors also express their sincere appreciation to all lecturers, colleagues, and institutions whose valuable insights, discussions, and support contributed to the development of this research. Finally, the authors are grateful to the researchers and organizations whose published works and official reports served as important references for this study.

6. REFERENCES

Anhar, I. P., Mardiana, R., & Sita, R. (2022). Dampak Kebakaran Hutan dan Lahan Gambut terhadap Manusia dan Lingkungan Hidup (Studi Kasus Desa Bunsur, Kecamatan Sungai Apit, Kabupaten Siak, Provinsi Riau). Jurnal Sains Komunikasi dan Pengembangan Masyarakat, 6(1), 75–85.

Arum, I. S., Handayani, I. G. A. K. R., & Najicha, F. U. (2021). Pertanggungjawaban Indonesia terhadap Pencemaran Udara Akibat Kebakaran Hutan dalam Hukum Internasional.

Cahyono, S. A., Warsito, S. P., Andayani, W., & Darwanto, D. H. (2015). Faktor-Faktor yang Mempengaruhi Kebakaran Hutan di Indonesia dan Implikasi Kebijakannya.

Firmansyah, M. A., & Subowo, G. (2012). Dampak kebakaran lahan terhadap kesuburan fisik, kimia, dan biologi tanah serta alternatif penanggulangan dan pemanfaatannya. *Jurnal Sumberdaya Lahan*, *6*(2), 178970.

Kristanto, P. (2004). Ekologi Industri. (*WHO Global Air Quality Guidelines*, n.d.)

Lestari, P. W., Pamungkas, V. F., Guntoro, P., & Dewanto, A. A. (2023). Penyuluhan Dan Simulasi Bahaya Kebakaran Akibat Gas Dan Listrik. *Jurnal Lentera*, *3*(1), 16-23.

Taufida, T., Romsan, A., & Antoni, M. (2024). Dampak Kebakaran Lahan Terhadap Kesehatan Masyarakat Kabupaten Ogan Komering Ilir Ditinjau Dari Undang–Undang No 32 Tahun 2009. *Prepotif: Jurnal Kesehatan Masyarakat Учредители: Universitas Pahlawan Tuanku Tambusai*, *8*(2), 3028-3038.